Static magnetic order and anisotropy of the layered cobalt dioxides $Bi_{1.6}Pb_{0.4}Sr_2Co_2O_y$ and $Bi_2Sr_2Co_2O_y$

J. Sugiyama[1], Y. Ikedo[1], H. Nozaki[1], P. L .Russo[2], J. H. Brewer[2,3], E. J. Ansaldo[2], G. D. Morris[2], K. H. Chow[4], D. Andreica[5], A. Amato[6], T. Fujii[7], S. Okada[8], and I. Terasaki[8]

[1]*Toyota Central Research and Development Labs. Inc., Nagakute, Aichi 480-1192, Japan*
[2]*TRIUMF, 4004 Wesbrook Mall, Vancouver, BC, V6T 2A3 Canada*
[3]*CIfAR and Department of Physics and Astronomy, University of British Columbia, Vancouver, BC, V6T 1Z1 Canada*
[4]*Department of Physics, University of Alberta, Edmonton, AB, T6G 2G7 Canada*
[5]*Faculty of Physics, Babes-Bolyai University, 3400 Cluj-Napoca, Romania*
[6]*Lab. for Muon-Spin Spectroscopy, Paul Scherrer Institut, 5232 Villigen PSI, Switzerland*
[7]*Cryogenic Center, University of Tokyo, 2-11-16 Yayoi, Bunkyo-ku, Tokyo 113-0032, Japan*
[8]*Department of Applied Physics, Waseda University, Tokyo 169-8555, Japan*

The magnetism of a Pb-doped $Bi_2Sr_2Co_2O_y$ (BSCO) crystal has been investigated by μ^+SR spectroscopy. Weak transverse-field (wTF-) μ^+SR measurements show that the whole sample enters into a magnetic state below $\sim$4.5 K. Combining the results of zero-field (ZF-) μ^+SR experiment with susceptibility measurements, it is clarified that the sample is in a ferromagnetic ordered phase with a Curie temperature (T_C) of 4.7 K and with the ordered internal magnetic field almost parallel to the c-axis. On the other hand, a pure BSCO crystal is also found to exhibit a bulk magnetic transition at 1.0 K by μ^+SR. Since the relationship between the reduced transition temperature and reduced internal magnetic filed for BSCO is almost equivalent to that for Pb-doped BSCO, the origin of the magnetic transition for both crystals is thought to be explained by common physics.

Although both wTF- and ZF- measurements confirm the absence of static magnetic order above T_C for both crystals, weak longitudinal-field measurements indicate the existence of a local maximum around 60 K ($=T_A$) in the temperature dependence of the relaxation rate, implying the increase in magnetic inhomogeneity towards T_A. This suggests an essential role of magnetic fluctuations on the metal-to-insulator-transition around 60 K [1], which is seen in the T dependence of resistivity for Pb-doped BSCO and BSCO [2].

[1] J Sugiyama et al., Phys. Rev. Lett. 92 (2004) 017602.
[2] T Fujii et al., Jpn. J. Appl. Phys. 41 (2002) L783.